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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/849,530	05/07/2001	Vincent J. McGahay	F19-98-1721/S2	1010

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INTERNATIONAL BUSINESS MACHINES CORPORATION  
DEPT. 18G  
BLDG. 300-482  
2070 ROUTE 52  
HOPEWELL JUNCTION, NY 12533

EXAMINER

MALDONADO, JULIO J

ART UNIT PAPER NUMBER

2823

DATE MAILED: 12/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.



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09/849,530	05/07/2001	Vincent J. McGahay	FI9-98-172US2	1010

7590 02/14/2002  
Burton A. Amernick, Esquire  
Connolly Bove Lodge & Hutz LLP  
Suite 800  
1990 M Street, N.W.  
Washington, DC 20036-3425

EXAMINER

COLLINS, DEVEN M

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 02/14/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/849,530

Applicant(s)

MCGAHAY ET AL.

Examiner

Julio J. Maldonado

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 18 April 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 15-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-17, 20, 21 and 26-30 is/are rejected.
- 7) ☒ Claim(s) 18, 19 and 22-25 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 7.
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

1. The non-final rejection as set forth in paper No. 5 is withdrawn in response to applicants' request for reconsideration.
2. A new rejection is made as set forth in this Office Action.
3. Claims 15-30 are pending in the application.

#### ***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 15-17, 20, 21 and 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Ngo et al. (U.S. 6,153,523) in view of Joshi et al. (U.S. 5,420,069).

In reference to claim 15-17, 26 and 29, Van Ngo et al. (Figs.1-4) in a related method to form a copper damascene structure, teach the steps of providing a germanium-containing layer (30) onto at least one surface of a copper member (13A); and providing a layer of silicon nitride (40) on the germanium-containing layer (30), wherein the copper member comprises copper or a copper alloy, wherein silicon nitride does not adhere well to the copper (column 3, line 38 – column 7, line 7).

Van Ngo et al. fail to teach forming that the layer of germanium-containing layer comprises copper germanide. However, Joshi et al. (Figs.2A-2B) in a related method to form a copper damascene structure teach providing a layer of copper germanide (100)

over a layer of copper (80) by flowing germane over the structure at a temperature of 200 to 450°C (column 2, line 9 – column 3, line 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form copper germanide as taught by Joshi et al. in the copper damascene structure of Van Ngo et al., since this would prevent corrosion of the copper surface (column 2, lines 45-53).

In reference to claims 20, 21, 27 and 28, Van Ngo et al. in combination with Joshi et al. substantially teach all aspects of the invention but fail to show forming the copper germanide layer to a thickness of about 100 to about 1,000Å; forming the copper member to a thickness of about 1,000 to about 20,000Å; and forming the layer of silicon nitride to a thickness of about 100 to about 20,000Å. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

6. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Ngo et al. ('523) in view of Joshi et al. ('069) as applied to claims 15-17, 20, 21 and 26-29 above, and further in view of Applicants' admitted prior art in the instant application.

Van Ngo et al. in combination with Joshi et al. substantially teach all aspects of the invention but fail to teach providing silicon oxide over the germanium containing layer, wherein silicon oxide does not adhere well to the copper surface. However, the

prior art teach that silicon oxide does not adhere well to a copper surface (page 1, line 9 – page 2, line 28). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to provide silicon oxide as taught by the prior art in the copper damascene formation method of Van Ngo et al. and Joshi et al., since silicon oxide is a common material used in the formation of dielectric layers.

***Allowable Subject Matter***

7. Claims 18, 19, 22-25 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record, Van Ngo et al. U.S. 6,153,523 teach a related method to form a copper damascene structure the steps of providing a germanium-containing layer (30) onto at least one surface of a copper member (13A); and providing a layer of silicon nitride (40) on the germanium-containing layer (30), wherein the copper member comprises copper or a copper alloy, wherein silicon nitride does not adhere well to the copper (column 3, line 38 – column 7, line 7). However, Van Ngo et al. neither teach nor suggest the a germanium-containing layer comprising copper germanide, copper oxide, copper nitride or combinations thereof over the copper member; and providing a gaseous composition comprising about 0.05 to about 5% of germane and a second gas selected from the group consisting of nitrogen, helium, argon, and mixtures thereof.

Joshi et al. to 5,420,069 (Figs.2A-2B and column 2, line 9 – column 3, line 3) teach a method of forming a copper damascene including forming copper germanide layer (100) over a copper member (80) by flowing germane over the copper member (80). However, Joshi et al. neither teach nor suggest forming germanium nitride, germanium oxide or combinations thereof; and forming the germanium containing layer by providing a gaseous composition comprising about 0.05 to about 5% of germane and a second gas selected from the group consisting of nitrogen, helium, argon, and mixtures thereof.

#### ***Response to Arguments***

9. Applicant's arguments with respect to claims 15-30 have been considered but are moot in view of the new ground(s) of rejection.

#### ***Conclusion***

10. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via [julio.maldonado@uspto.gov](mailto:julio.maldonado@uspto.gov). If attempts to reach the examiner by telephone

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are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

**Julio J. Maldonado**

Patent Examiner

Art Unit 2823

703-306-0098

julio.maldonado@uspto.gov



Olik Chaudhuri

Supervisory Patent Examiner  
Technology Center 2800